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A HOMEMADE BALE LOADER

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Windrow pickup hay balers make it possible for hay growers and feeders to save labor. A further saving of labor is made by the use of a machine which picks up and elevates to a point above the truck bed the bales which are scattered over the field by the baler.

A sufficient number of manufactured bale loaders is not now available because of a critical-material shortage; this circular describes a bale loader[3] which has been developed by the Division of Agricultural Engineering, University of California. This loader is constructed mainly from noncritical materials and old automobile parts. It can be built by farmers or others who have access to a welding outfit and a lathe.

Fig. 1.--Loader in operation, with a bale entering the chute.

Fig. 2.--Bale being delivered to the loader platform.

The loader is ground-driven. The drive is made from two old automobile rear axles. A Ford "V-8" rear axle carries the loader and drives a countershaft made up from parts of a Ford "Model A" rear axle. These axles were selected because the torque tube and radius rods of the "V-8" make a simple and rugged support for the countershaft, bale chute, and platform. Furthermore, these two readily available axles can be combined with a minimum of shopwork. The bale chute and platform are made of wood, while the hitch bars and all braces are made from standard black pipe.

The accompanying photographs and the working drawing (fig. 20) illustrate the various parts and show how they are assembled to make a traction-driven bale loader which slides the bales up a chute by means of a single chain (figs. 1 and 2).

Procedure

The following instructions may aid in constructing this bale loader. First check the list of materials and see that everything needed is at hand or can be obtained.

Countershaft Assembly

Completely dismantle the "Model A" Ford rear axle, and discard the axle shafts, differential spider, and bevel pinions. Machine a countershaft according to dimensions given in figure 3, and weld it into one half of the differential case as shown at A, figure 4. Cut axle housings from the differential housing at the welds (see A, fig. 5). Machine two ½-inch plates to fit into the openings on the differential housing where the axle housings were cut away. One plate should be drilled and tapped at the center for a ½-inch thread (see B, fig. 5). The other plate is bored to a loose fit for a 1¼-inch shaft, then counterbored to take a no. 50049 National grease retainer (fig. 6). Leave the grease retainer out until the final assembling, otherwise it might be damaged. Weld both plates into place (see A, fig. 5). Assemble the master gear, differential case, countershaft and differential housing. Install the master gear in the differential case so that it will turn in the opposite

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[3]Investigation has not revealed any patent which this device would infringe. However, the University of California assumes no responsibility in this respect if found otherwise.

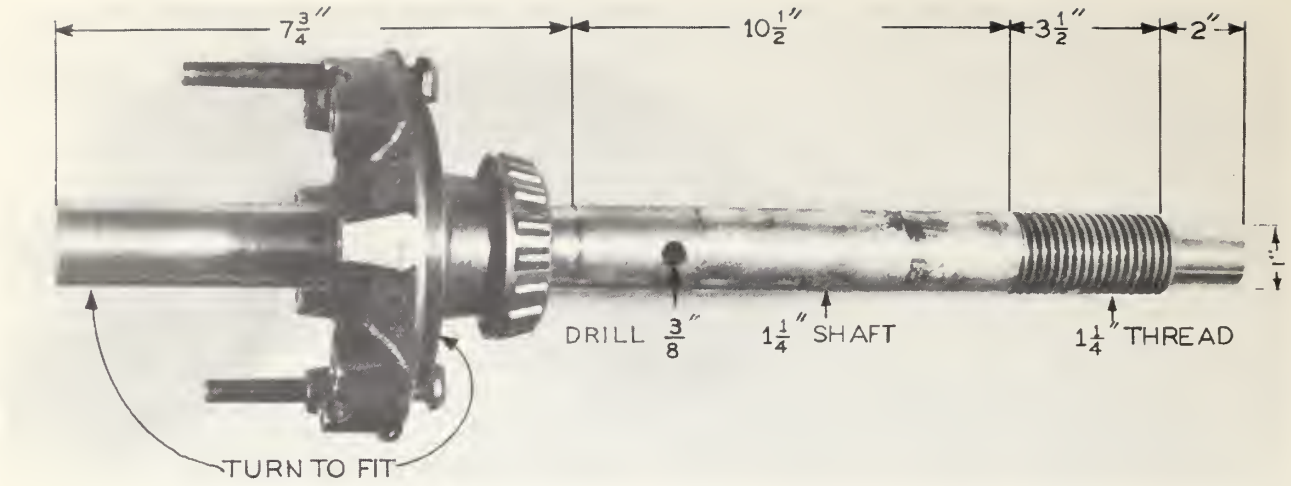


Fig. 3.--Countershaft machining dimensions. The exact location of the 3/8-inch drilled hole (for the snap-clutch pin B, fig. 7) is explained under "Snap-Clutch and Drive-Sprocket Assembly."

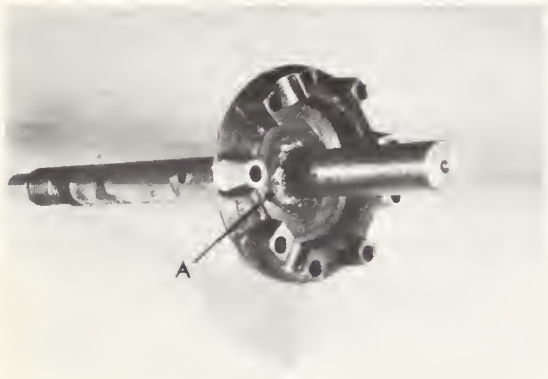


Fig. 4.--Countershaft welded into half of the differential case at A.

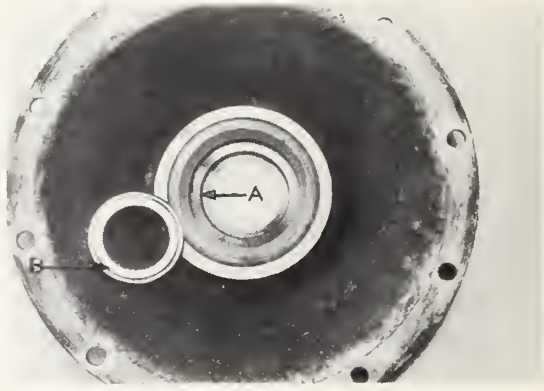


Fig. 6.--Differential housing. Cover plate showing ½-inch plate counterbored at A, for grease retainer B.

Fig. 5.--Countershaft snap-clutch and drive-sprocket assembly installed. A, Point where axle housings were cut away and where plate is welded in. B, Drill and tap ½-inch thread. C, Should not be welded, but should project down to and be cap-screwed in place at B.

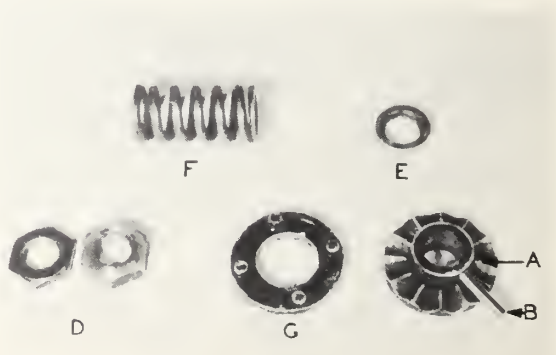


Fig. 7.--Snap-clutch parts. A, Snap-clutch plate with hub welded in. B, Snap-clutch pin. C, Snap-clutch plate with anchor lugs. D, Lock nuts. E, Grease retainer, National no. 50049. F, Clutch spring.

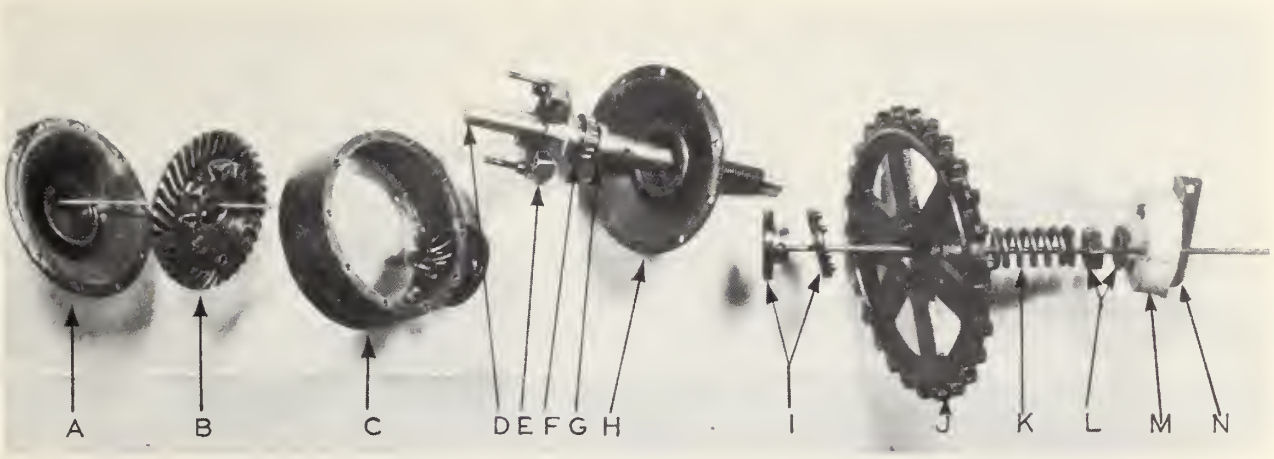


Fig. 8.--Countershaft parts ready for assembly. A, Differential housing cover, closed. B, Master gear and half of differential case. C, Differential housing and drive pinion. D, Countershaft. E, Half of differential case. F, Timken bearing. G, Grease retainer. H, Differential housing cover open for countershaft. I, Snap-clutch plates. J, 27-tooth no. 62 chain sprocket wheel. K, Clutch spring. L, 1¼-inch lock nuts. M, Maple bearing. N, 6-inch angle iron bracket, ¼ × 1½ × 2½ × 6 inches.

direction to that of the "V-8" wheels. Do not assemble drive pinion and bearing until later.

Snap-Clutch and Drive-Sprocket Assembly

The four anchor lugs are removed from the back side of one snap-clutch plate by grinding. A hub 1½ inches long is bored for a 1¼-inch shaft, the outside is turned to a press fit, then pressed into the snap-clutch plate until flush with the back side of the plate, then welded into place; the weld is made on the back side of the clutch plate (see A, fig. 7). The snap-clutch plate is then placed on the countershaft with the back side of the plate toward the differential housing, leaving 1/8-inch clearance between the plate and the housing. A 3/8-inch hole is then drilled through the snap-clutch-plate hub and countershaft, for a shear pin. The pin B, of figure 7, is made to a drive fit, and does not extend beyond the hub as the other snap-clutch plate must move freely over it. The 27-tooth, no. 62 chain sprocket wheel (fig. 8), which has a hub on one side only, is bored to a running fit for the 1¼-inch countershaft. The side opposite the hub is faced and counterbored to take the extended hub of the snap-clutch plate and drilled to receive anchor lugs of the other snap-clutch plate C of figure 7; also, I and J, figure 8. Figure 7 shows all parts of the snap clutch, also the National grease retainer. Figure 8 is an "exploded" view of the countershaft, snap clutch, differential housing, and main drive-sprocket assemblies, with all parts in their proper sequence. Figure 9 shows the details of the countershaft and outboard bearing.

Torque-Tube and Drive-Shaft Assembly

Referring to figure 10, A is cut from B just above the radius-rod anchor lug. The flange end, C, is cut from D, 3 inches from the flange face (and later welded onto B). A disk ½ inch thick is machined to fit into C, and counterbored to receive a no. 50045 National grease retainer, which is not pressed into place until the final assembling. The ½-inch plate is then welded into C, at the end opposite the flange, (see A, fig. 11). E(fig. 10) is cut from F, the cut end machined and bored ½ inch, and welded as shown at E - G. C is then cap-screwed to the "Model A" differential housing. The drive pinion and bearing are now installed. G is then put in place and the nut tightened lightly; B is cap-

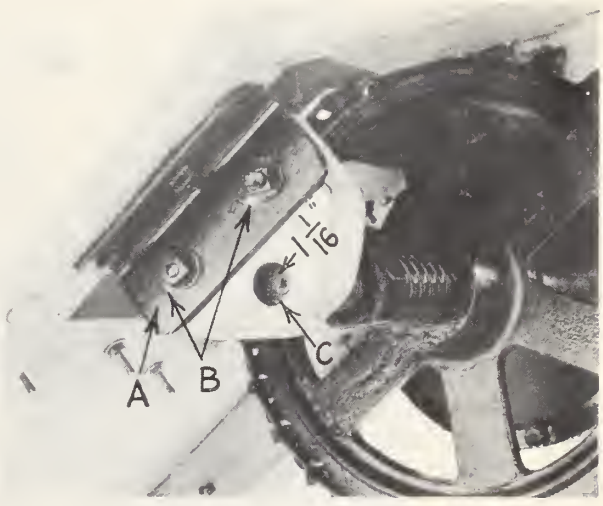


Fig. 9.--Countershaft outboard bearing. A, Angle iron, ¼ × 1½ × 2½ × 6 inches. B, Slots to tighten chain, 7/16 × 1-3/8 inches. C, 1½ × 4 × 5 inch maple bearing, hole 1-1/16 inches in diameter.

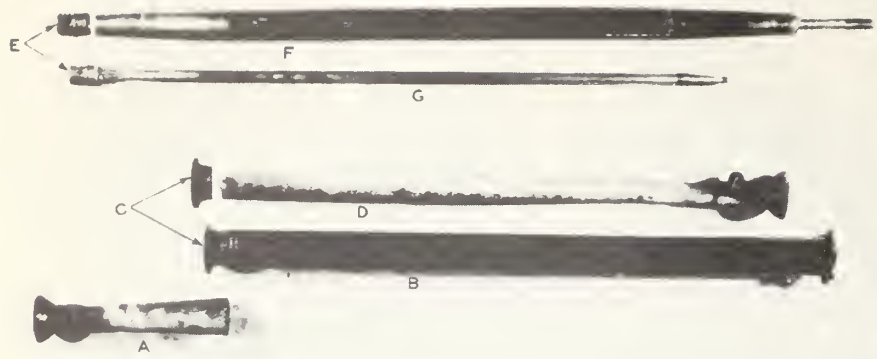


Fig. 10.--Torque tube and drive-shaft details. A and B, Ford "V-8" torque tube. C and D, Ford model A torque tube. E and F, Ford "V-8" drive shaft. G, Ford model A drive shaft.

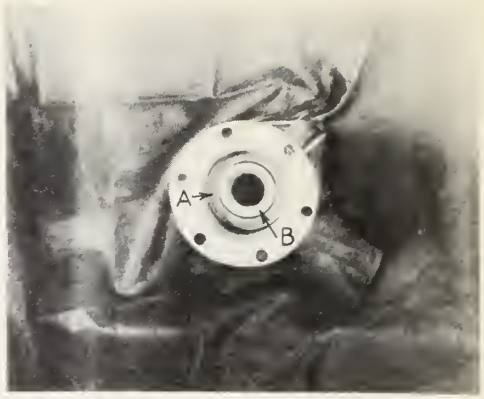


Fig. 11.--Model-A Ford drive-shaft grease retainer. A, The ½-inch plate welded in place. B, National grease retainer no. 50045.

screwed into place on the "V-8" differential housing and G is then put into B. E(splined coupling) must slip over the splined end of the short drive-shaft of the "V-8". Level the "V-8" rear axle with torque tube B in a horizontal position; also level the countershaft so that the "V-8" rear axle and the countershaft are parallel. There should be 1/8 inch clearance between the ends of G and the short drive shaft of the "V-8." C now extends into B, and should be centered and welded in position. To disassemble, the drive-pinion nut must be removed and the drive shaft, G, removed from the drive pinion. Replace all gaskets, press in grease retainers, reassemble, and fill both differential housings with transmission oil.

Bale Chute, Bracing, and Hitch Bars

The working drawing, figure 20, shows the dimensions and details of the bale chute, platform, and bracing. The bale chute and platform are made of wood, while the bracing and hitch bars are made from standard black pipe. The carrier chain slot is centered over the 27-tooth sprocket wheel which places the bale chute to the right of the center of the rear axle assemblies.

Figure 12 shows brace anchor lugs welded to "V-8" rear axle housings. Figure 13 illustrates the lower end of the bale chute, showing runners, pickup chains, and carrier chain, which parts are seen from the underside in figure 14. Figure 15 shows the hitch bars and brackets attached to the

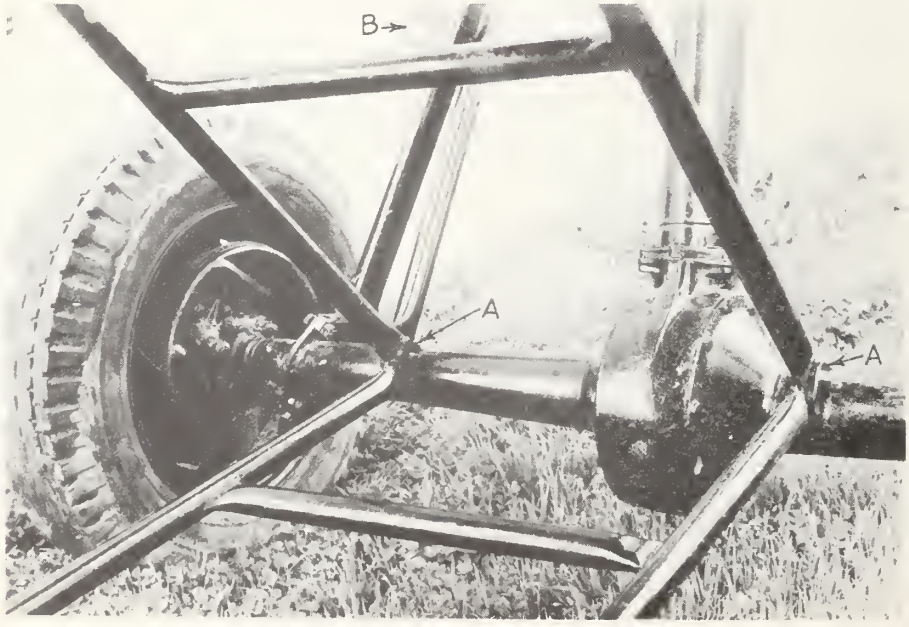


Fig. 12.--Braces attached to the rear axle. A, Anchor lugs welded on the rear-axle housing to attach chute and platform braces. B, Rear spreader-bar bracket on radius rod.

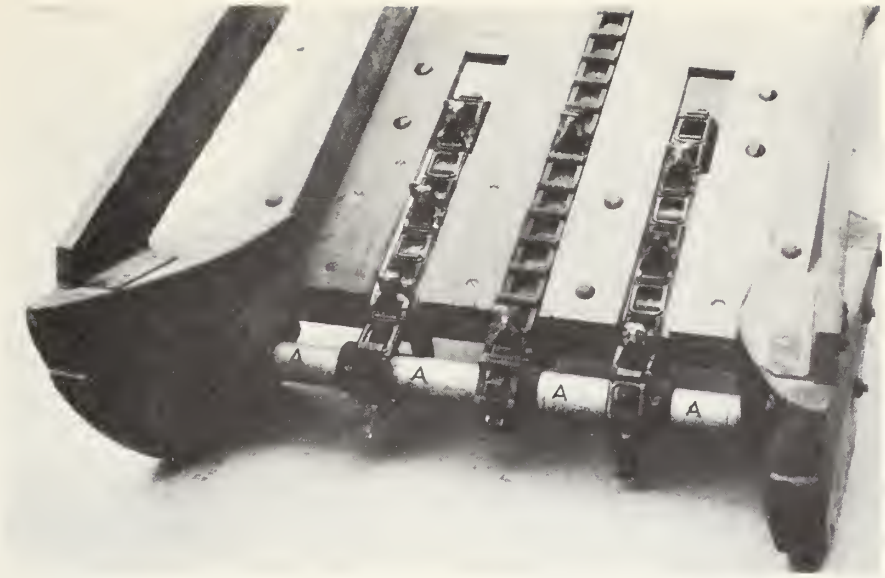


Fig. 13.--Lower end of the bale chute showing runners, pickup chains, and carrier chain. A, Pieces of 1-1/4 inch iron pipe over 1-1/8 inch lower pickup shaft to prevent winding.

Fig. 14.--Lower end of the bale chute viewed from the underside. A, Pickup chains. B, Carrier chain. C, Lower pickup shaft. D, Lower pickup shaft bearings. E, Upper pickup shaft. F, Upper pickup shaft bearings slotted to tighten pickup chains. G, Lower bracket of tow bar.

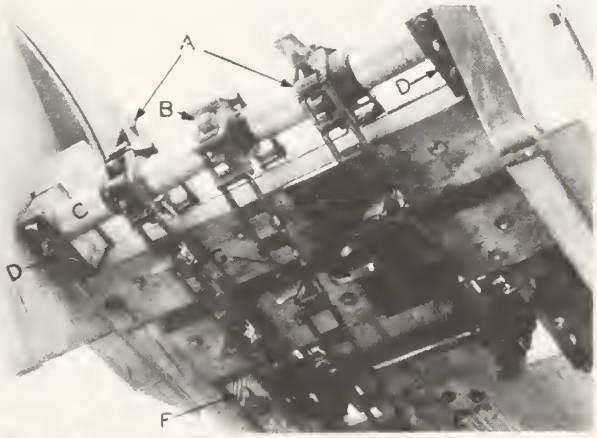


Fig. 15.--Hitch bars and brackets attached to the loader. A, Front spreader bar, 1/2 inch iron pipe. B, Rear spreader bar 1/2 inch iron pipe. C, Push bar 1-1/4 inch iron pipe. D, Hitch-bar bracket on bale chute. E, Rear spreader-bar bracket on radius rod.

loader and figure 16 indicates how the hitch bars are attached to the truck.

The hitch bars will be of different lengths for different trucks. The hitch hooks are of the ball type and the brackets (see D, fig. 16) into which they hook should be drilled so the ball will just pass through. This type of hook will not disengage while under load, but is readily removed when not under load.

The loader should be lined up with the truck for fitting the hitch bars. The loader is placed on the left side of the truck with the right loader wheel a few inches in front of the left rear truck wheel, on most 1½-ton trucks. Hitch bars and hooks of the type shown make a flexible attachment to the truck which can be hooked or unhooked in a few seconds, yet the truck can be backed or turned in any direction without interference from the loader.

If the carrier chain is removed, the bale loader may be trailed on the highway at 30 miles per hour. Figures 17 and 18 show the trailer

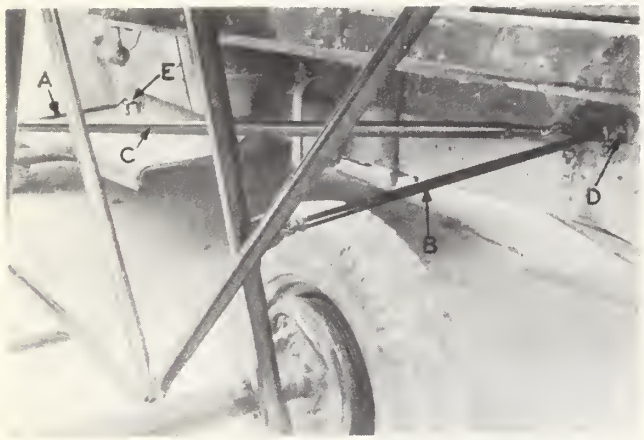


Fig. 16.--Hitch bars and brackets attached to the truck. A, Front spreader. B, Rear spreader bar. C, Push bar. D, Hitch-bar bracket on the truck sill. E, Eye bolt to hold the front spreader bar.

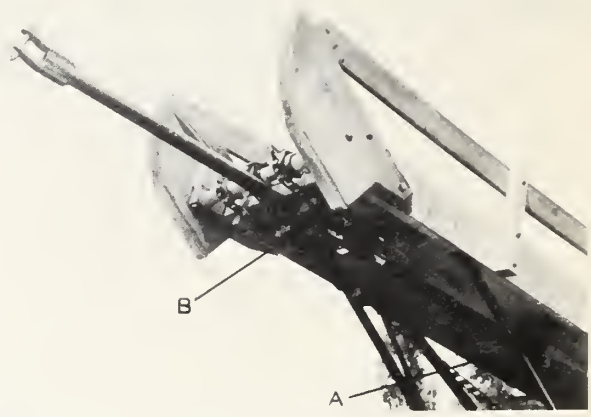


Fig. 17.--Tow bar installed. A, Upper draw-bar bracket. B, Lower draw-bar bracket.

Fig. 18.--Tow bar removed from the loader. A, 1-1/4 inch iron pipe. B, Part of 1-1/2 inch pipe coupling welded to the bar. C, Other part of the pipe coupling held to tow bar by a bolt.

Fig. 19.--Loader being towed.

bar and brackets and figure 19 illustrates how the loader is trailed behind a truck.

The bale loader enables two people to load bales rapidly in the field; one drives the truck and the other removes the bales from the loader platform and stacks them on the truck bed. No one is needed on the ground, but the driver may move an occasional bale which is badly out of line. The bales should lie on edge, and not directly across the windrow. The truck can be steered, however, to pick up bales that are at some angle to the line of travel. Simple guide rods on the rear of the baler will place the bales in a good position for the bale loader. The loader may be operated at speeds up to 4 miles an hour under good field conditions.

Bill of Materials

Parts:

1 Ford "V-8" rear end
1 Ford model A rear end
2 Ford "V-8" wheels
30' no. 62 malleable chain
6' no. 62 C-1 attachment
1 only, 27-tooth no. 62 chain sprocket wheel
5 only, 6-tooth no. 62 sprocket wheels
1 pr. IHC* snap clutch plates no. B72170
1 JD† snap clutch spring no. C1983
1 National grease retainer no. 50045
1 National grease retainer no. 50049
1 only, 1-1/4 USC hex. nut
1 only, 3/8" × 2" C.R. pin
2 only, 1-1/8" × 1" set collars
4 only, 5/16" × 2" keys
5 only, 5/16" × 3/8" set screws
5 angle Zerk grease fittings

Lumber:

2 pcs. 2" × 6"—14' S4S
1 pc. 2" × 6"— 4' S4S
1 pc. 2" × 4"—12' S4S
2 pcs. 2" × 4"— 8' S4S
1 pc. 2" ×12"— 4' S4S
3 pcs. 1" × 4"—12' S4S
2 pcs. 1" ×10"—12' vertical grain
1 pc. 1" ×10"— 8' vertical grain
1 pc. 3/8" ×1-3/4"—12' maple flooring
1 pc. 2" × 4" — 2' maple flooring

Hardware:

72 only, 1/4" × 3" flathead bolts
12 only, 1/4" × 2-1/2" carriage bolts
14 only, 3/8" × 6" carriage bolts
12 only, 3/8" × 5" carriage bolts
30 only, 5/16" × 4" carriage bolts
4 only, 5/16" × 3" lag screws
4 only, 1/4" × 1-1/2" lag screws
24 no. 10 (1-1/2") wood screws

Steel:

20" of 1-1/4" C.R. shaft
24" of 1-1/8" C.R. shaft
18" of 1-1/8" C.R. shaft
2' of 5/8" round
5' of 1/8" × 2" flat

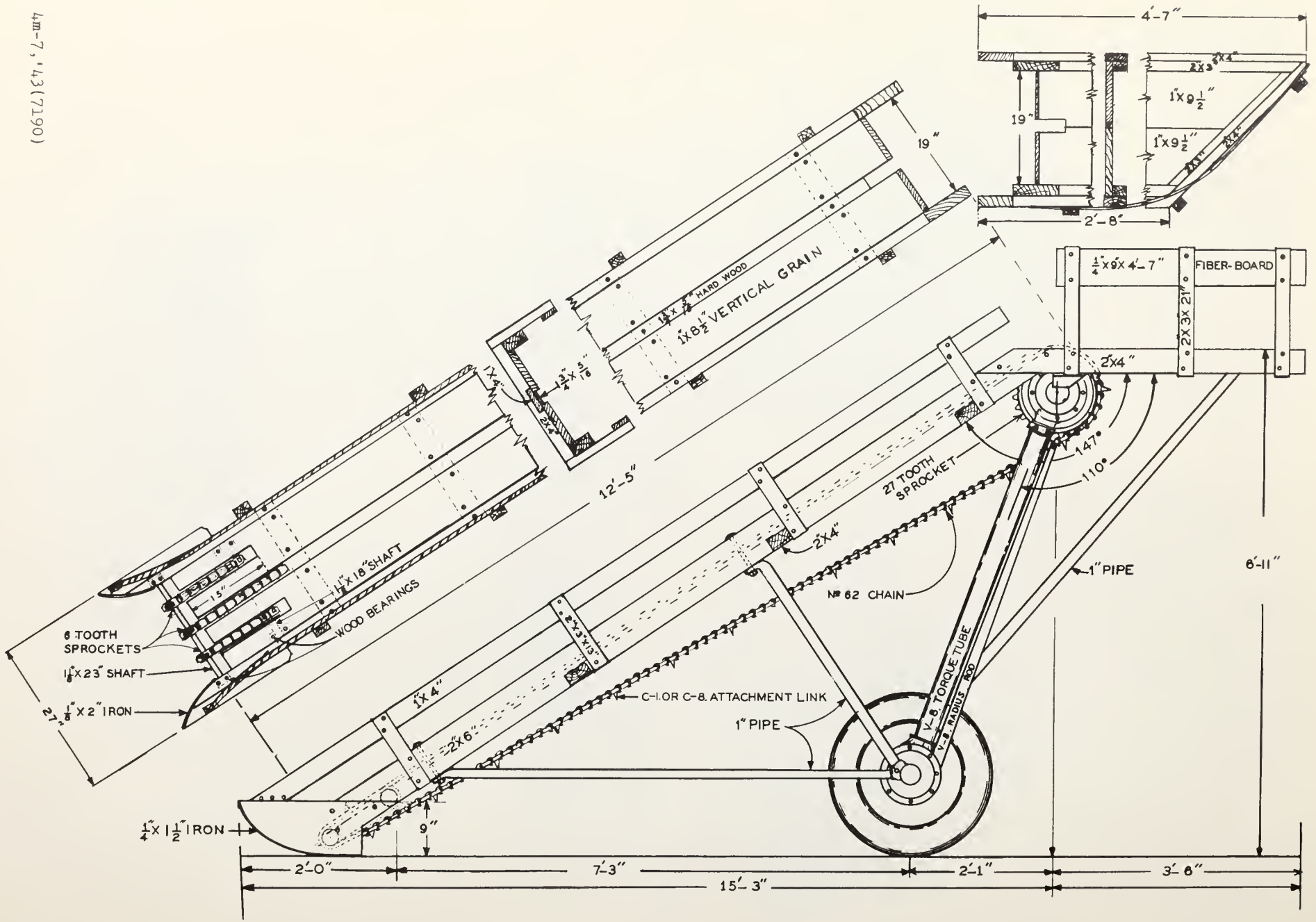
Pipe:

40' of 1" black pipe
7' of 1-1/4" black pipe
6' of 1/2" black pipe

Miscellaneous:

1 pt. black paint
1/2 gal. linseed oil

* International Harvester Co.
† John Deere Company


4'-7"
19"
1"X9½"
1"X9½"
2'-8"
¼"X9"X4'-7"
FIBER-BOARD
2X3X21"
2X4"
19"
1"X8½" VERTICAL GRAIN
1¾"X⅝" HARD WOOD
1"X4"
1¾"X⅝"
2X4"
12'-5"
147°
110°
27 TOOTH SPROCKET
2X4"
1"X18" SHAFT
15"
WOOD BEARINGS
6 TOOTH SPROCKETS
1⅛"X23" SHAFT
2½⅛"X2" IRON
№62 CHAIN
1" PIPE
6'-11"
2"X3"X13"
1"X4"
2"X6"
C-1 OR C-8 ATTACHMENT LINK
1" PIPE
V-8 TORQUE TUBE
V-8 RADIUS ROD
¼"X1½" IRON
9"
2'-0"
7'-3"
2'-1"
3'-6"
15'-3"